

A. MOTOROLA S-RECORD FORMAT

The Motorola S-record format is a method of representing binary memory images in an ASCII form. The primary use of S-records is to provide a convenient form for transporting programs between computers. Since most computers have a means of reading and writing ASCII information, the format is widely applicable.

An S-record file consists of a sequence of S-records of various types. The entire content of an S-record is ASCII. When a hexadecimal number needs to be represented in an S-record, it is represented by the ASCII characters for the hexadecimal digits comprising the number. Each S-record contains the five fields shown in Figure A-1. Table A-1 describes each field.

| Field | <i>type</i> | <i>length</i> | <i>address</i> | <i>data</i> | <i>cksum</i> |
|--------------------|-------------|---------------|----------------|-------------|--------------|
| Size in characters | 1 | 1 | 2 | 2, 4 or 6 | varies 2 |

Figure A-1. S-record Format

Table A-1. S-record Field Descriptions

Field Description

S

The ASCII character S. This signals the beginning of the S-record.

type

A digit between 0 and 9, represented in ASCII, with the exceptions that 4 and 6 are not allowed. The use of each type value is explained in Table A-2.

length

The number of character pairs in the record, excluding the first three fields. (That is, one half the number of total characters in the address, data, and checksum fields.) This field has two hexadecimal digits, representing a one-byte quantity.

address

The address at which the data portion of the record is to reside in memory. The data goes to this address and successively higher numbered addresses. The length of this field is determined by the record type in the second byte of the S-record.

data

A variable length field containing the actual data to be loaded into memory. Specify each byte of data as a pair of hexadecimal digits in ASCII.

Appendix A

cksum

A checksum compute over the length, address, and data fields. Compute the checksum as follows:

- add the values of the character pairs in the length, address, and data fields
- take the one's complement of the sum
- drop the most significant byte

Enter the least significant byte value in the checksum field as two ASCII hexadecimal digits.

There are eight types of S-records. They can be divided into two categories: records containing actual data and records used to define and delimit groups of data-containing records. Types 1, 2, and 3 are reserved for records in the first category; types 0, 5, 7, 8, and 9 for reserved for records in the second category. Types 4 and 6 are not allowed. Table A-2 defines the types.

Note: All byte values in Table A-2 are expressed as two ASCII characters representing the hexadecimal value.

Table A-2. S-Record Type Definitions

- 0** This type is a header record used at the beginning of a group of S-records. The data field can contain any desired identifying information. The address field is two bytes long and is normally zero.
- 1** This type of record contains normal data. The address field is two bytes long.
- 2** This type is the same as type 1 except the address field is 3 bytes long.
- 3** This type is the same as type 1 except the address field is 4 bytes long.
- 5** This type indicates the number of type 1, 2, and 3 records in a group of S-records. The count is placed in the address field. The data field is empty.
- 7** This record signals the end of a block of type 3 S-records. If desired, the 4-byte address field can be used to contain an address at which to pass control. The data field is empty.
- 8** This type is the same as type 7 except that it ends a block of type 2 S-records and the address field is 3 bytes long.

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This is the same as type 7 except ending a block of type 1 S-records and the address field is 2 bytes long.